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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
LUM, LEON YUN BON	

ART UNIT	PAPER NUMBER
1641	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/555,729	NIE ET AL.	
	Examiner	Art Unit	
	Leon Y. Lum	1641	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 March 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *198-215 and 218-223* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *198-215 and 218-223* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 198-201, 203, 218 and 220 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. to 6,710,366 to Lee *et al.* ("Lee").

i. Independent claim 198 is anticipated

Lee describes a quantum dot with a continuous graded alloy of distinct core and shell materials in an "interface region" between the core and shell. *See* column 7, lines 17-36. In this embodiment, the center of the quantum dot is purely core material and the outer surface of the quantum dot is purely shell material, with a continuous transition of the materials in the interface region, in which the transition is an alloy of the core and shell materials. *Id.* The core and shell materials can each comprise Group IV, Group II-VI or Group IV-VI semiconductor materials, including CdSe and CdTe. *See* column 13, lines 18-31 and lines 40-51.

ii. Dependent claims 199-201, 203, 218 and 220 are anticipated

Claims 199-201, 203, 218 and 220 are dependent on claim 198 and taught by Lee, as described below.

Regarding claim 199, the yield of the quantum dot can be between 35% and 95%. *See* column 42, lines 14-17.

Regarding claim 200, Lee teaches a Group II-VI semiconductor material. *See* supra, rejection of claim 198.

Regarding claim 201, Lee teaches the interface region can comprise an alloy of the core and shell materials, which can each be either CdSe or CdTe, as described above. *See supra*, rejection of claim 198. Accordingly, Lee's teaching includes the embodiment in which the alloy is a combination of CdSe and CdTe, i.e., CdSeTe.

Regarding claim 203, Lee teaches that the core and shell materials can be CdSe or CdTe. *See* column 13, lines 23 and 44.

Regarding claims 218 and 220, the only claimed element is the quantum dot recited in parent claim 198. Accordingly, because Lee teaches claim 198, it also teaches claims 218 and 220.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made

to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 202, 204-215, 221 and 223 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, cited above, in view of U.S. Patent No. 6,207,392 to Weiss *et al.* ("Weiss").

i. Claim 202 is obvious

Lee does not teach the specific ratios of semiconductor materials claimed.

Weiss teaches that altering the concentration of an alloy in a nanocrystal can affect the emission wavelength of the alloyed semiconductor nanocrystal. *See* column 8, line 50 to column 9, line 11.

With the foregoing description in mind, one of ordinary skill in the art would have found it obvious to optimize the specific ratios of the cited semiconductor alloy, for e.g. CdSeTe, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 f.2d 272 (CCPA 1980). Here, the general conditions of the claim are taught in the prior, i.e., the claimed alloy is described by Lee. *See supra*, rejection of 201. Because Weiss indicates that the alloy concentration is a result-effective variable that can be optimized, the skilled artisan would have found it obvious to apply the rationale of *Boesch* to optimize the ratio of semiconductor material.

Moreover, Applicants have admitted that the claimed subject matter is prior art. *See* Specification, page 10, paragraph 0044 reciting "[s]uch semiconductors are known in the art, including for instance, $CdS_{1-x}Se_x$...wherein x is any fraction between 0 and 1." This type of admission can be relied upon in an obviousness rejection. *Riverwood Int'l Corp. v. R.A. Jones & Co.*, 324 F.3d 1346, 1354 (Fed. Cir. 2003); *see also* MPEP 2129. Accordingly, by Applicants' admission, the instant claim is obvious.

ii. Claim 204 is obvious

Lee does not teach that the quantum dot is conjugated to a biological agent and does not teach that the gradients vary amongst the population of quantum dots.

Weiss teaches that the emission wavelength of an alloyed semiconductor nanocrystal can be tailored by adjusting the concentration of the alloys. *See* column 8, line 50 to column 9, line 11. Adjusting the alloy concentration in this manner can benefit applications that require a set of nanoparticles having different emission wavelengths, but a uniform size. *Id.* For example, steric restrictions that prevent the presence of different particle sizes is no longer a concern. *Id.* Moreover, having an array of nanocrystals with different emissions allows a user to perform a multiplex assay, in which different nanocrystals are bound to different affinity molecules to detect multiple biological substances. *See* column 9, lines 14-35 and column 12, lines 7-44.

With the foregoing description in mind, one of ordinary skill in the art would have found if obvious to modify Lee's population of monodispersed quantum dots by adjusting the alloy concentrations to provide different gradients between quantum dots, as taught by Weiss. The skilled artisan would have been motivated to perform this modification based on Weiss's teaching that doing so would allow one to perform a multiplex assay to simultaneously detect different biological substances. Moreover, Lee and Weiss disclose the same type of semiconductor quantum dots (*see* Weiss, column 7, lines 36-50). Accordingly, the skilled artisan would have had a reasonable expectation of success in applying Weiss's teachings to Lee's quantum dots.

iii. Claim 205 is obvious

For this claim, Lee does not teach a quantum dot encapsulated within a polymer bead.

Weiss describes a semiconductor nanocrystal placed in a polymer sphere. *See* column 13, line 51. This configurations helps to provide a stable probe material for biological applications. *See* column 2, lines 6-17.

With the foregoing description, one of ordinary skill in the art would have found it obvious to modify Lee's teaching to encapsulate the quantum dot within a polymer sphere. The skilled artisan would have been motivated to perform the modification based on Weiss's description that this arrangement is helpful for producing a stable probe structure. Moreover, as discussed in the rejection of claim 204, Weiss describes the same type of semiconductor quantum dots. Accordingly, the skilled artisan would have had a reasonable expectation of success in combining the teachings of Lee and Weiss.

iv. Claims 206-209 are obvious

Regarding claim 206, Lee teaches a population of monodispersed quantum dots with a deviation of less than 5% root-mean-square. *See* column 8, lines 32-35.

Regarding claim 207, Lee teaches that the yield of the quantum dot can be between 35% and 95%. *See* column 42, lines 14-17.

Regarding claim 208, Lee teaches that the core and shell materials can comprise Group IV, Group II-VI or Group IV-VI semiconductor materials. *See* column 13, lines 18-31 and lines 40-51.

Regarding claim 209, Lee does not teach the specific ratios of semiconductor materials claimed, or that the quantum dot is encapsulated in a polymer bead.

Weiss teaches that altering the concentration of an alloy in a nanocrystal can affect the emission wavelength of the alloyed semiconductor nanocrystal. *See* column 8, line 50 to column 9, line 11.

With the foregoing description in mind, one of ordinary skill in the art would have found it obvious to optimize the specific ratios of the cited semiconductor alloy, for e.g. CdSeTe, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 f.2d 272 (CCPA 1980). Here, the general conditions of the claim are taught in the prior, i.e., the claimed alloy is described by Lee. *See supra*, rejection of 201. Because Weiss indicates that the alloy concentration is a result-effective variable that can be optimized, the skilled artisan would have found it obvious to apply the rationale of *Boesch* to optimize the ratio of semiconductor material.

Moreover, Applicants have admitted that the claimed subject matter is prior art. *See* Specification, page 10, paragraph 0044 reciting "[s]uch semiconductors are known in the art, including for instance, $CdS_{1-x}Se_x$...wherein x is any fraction between 0 and 1." This type of admission can be relied upon in an obviousness rejection. *Riverwood Int'l Corp. v. R.A. Jones & Co.*, 324 F.3d 1346, 1354 (Fed. Cir. 2003); *see also* MPEP 2129. Accordingly, by Applicants' admission, the instant claim is obvious.

v. Claims 210-212 are obvious

Claims 210-212 are dependent on claims 206-209 and taught by Weiss, as described below.

Lee does not teach that the quantum dot is conjugated to a biological agent and does not teach that the gradients vary amongst the population of quantum dots.

Weiss teaches that the emission wavelength of an alloyed semiconductor nanocrystal can be tailored by adjusting the concentration of the alloys. *See* column 8, line 50 to column 9, line 11. Adjusting the alloy concentration in this manner can benefit applications that require a set of nanoparticles having different emission wavelengths, but a uniform size. *Id.* For example, steric restrictions that prevent the presence of different particle sizes is no longer a concern. *Id.* Moreover, having an array of nanocrystals with different emissions allows a user to perform a multiplex assay, in which different nanocrystals are bound to different affinity molecules to detect multiple biological substances. *See* column 9, lines 14-35 and column 12, lines 7-44.

With the foregoing description in mind, one of ordinary skill in the art would have found if obvious to modify Lee's population of monodispersed quantum dots by adjusting the alloy concentrations to provide different gradients between quantum dots, as taught by Weiss. The skilled artisan would have been motivated to perform this modification based on Weiss's teaching that doing so would allow one to perform a multiplex assay to simultaneously detect different biological substances. Moreover, Lee and Weiss disclose the same type of semiconductor quantum dots (*see* Weiss, column 7, lines 36-50). Accordingly, the skilled artisan would have had a reasonable expectation of success in applying Weiss's teachings to Lee's quantum dots.

vi. Claim 213 is obvious

Claim 213 is dependent on claim 206 and taught by Weiss, as described below.

For this claim, Lee does not teach a quantum dot encapsulated within a polymer bead.

Weiss describes a semiconductor nanocrystal placed in a polymer sphere. *See* column 13, line 51. This configurations helps to provide a stable probe material for biological applications. *See* column 2, lines 6-17.

With the foregoing description, one of ordinary skill in the art would have found it obvious to modify Lee's teaching to encapsulate the quantum dot within a polymer sphere. The skilled artisan would have been motivated to perform the modification based on Weiss's description that this arrangement is helpful for producing a stable probe structure. Moreover, as discussed in the rejection of claim 204, Weiss describes the same type of semiconductor quantum dots. Accordingly, the skilled artisan would have had a reasonable expectation of success in combining the teachings of Lee and Weiss.

vii. Claims 214 and 215 are obvious

Claims 214 and 215 are dependent on claims 204 and 211, respectively. For the following reasons, they are obvious over the prior art.

Weiss teaches a method of detecting an analyte by contacting a sample with a plurality of seminconductor quantum dots and detecting emitted light from the quantum dots. *See* column 13, lines 23-40.

Because Weiss provides a specific application of Lee's quantum dots, one of ordinary skill in the art would have found this application as motivation to combine the

two references. Moreover, as discussed in the rejection of claim 204 above, the skilled artisan would have had a reasonable expectation of success in making the combination.

vii. Claims 221 and 223 are obvious

Claim 221 is dependent on base claim 206 and taught by Lee. Indeed the claim does not appear to further limit the base claim with an additional limitation. Accordingly, because Lee teaches the base claim, it also teaches claim 221.

Claim 223 is dependent on claim 221 and recites an intended use of the quantum dot. But because the claim does not recite any structural limitations, it does not lay claim to a quantum dot that is distinct from the quantum dot in the base claim. Accordingly, because Lee teaches the base claim, it also teaches claim 223.

Claim 219 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee, cited above, in view of U.S. Patent No. 6,846,565 to Korgel *et al.* ("Korgel").

Lee is described above, but does not teach an alloyed quantum in a light emitting diode.

Korgel describes semiconductor nanoparticles capable of being implemented in light emitting diodes. *See* column 1, lines 37-47 and column 2, lines 44-59.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lee's quantum dots by placing them in a light emitting device. The skilled artisan would have a reason for performing this modification since Lee teaches that the quantum dots are applicable in any optical-electrical device (*see* column 1, lines 31-33) and an LED is one type of optical-electrical device. Moreover, Korgel teaches

that applicable nanoparticles include those having the same semiconductor materials as Lee's quantum dots. *See* column 1, lines 45-47. Accordingly, the skilled artisan would have a reasonable expectation of success in placing Lee's quantum dots in an LED.

Claim 222 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee in view of Weiss, both cited above, and further in view of Korgel, also cited above.

Lee and Weiss are described above, but do not teach that the alloyed quantum dot is in a light emitting diode.

Korgel describes semiconductor nanoparticles capable of being implemented in light emitting diodes. *See* column 1, lines 37-47 and column 2, lines 44-59.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Lee and Weiss's quantum dots by placing them in a light emitting device. The skilled artisan would have a reason for performing this modification since Lee teaches that the quantum dots are applicable in any optical-electrical device (*see* column 1, lines 31-33) and an LED is one type of optical-electrical device. Moreover, Korgel teaches that applicable nanoparticles include those having the same semiconductor materials as Lee's quantum dots. *See* column 1, lines 45-47. Accordingly, the skilled artisan would have a reasonable expectation of success in placing Lee's quantum dots in an LED. Furthermore, Korgel teaches that applicable nanoparticles include those having the same semiconductor materials as Lee's quantum dots. *See* column 1, lines 45-47. Accordingly, the skilled artisan would have a

reasonable expectation of success in placing Lee and Weiss's quantum dots in Korgel's LED.

Response to Arguments

Applicants present arguments traversing the previous Office Action in the response filed March 27, 2009. *See* pages 2-3. Specifically, Applicants submit that the Lee reference is not prior art in light of Applicant's conception and reduction to practice of the claim invention prior to Lee. *Id.* Applicants offer a Declaration under 37 CFR 1.131 ("Rule 131 Declaration") and Exhibit A, appendages to the response, in support of their argument. For the reason below, Applicant's argument is not convincing.

Exhibit A is an article authored by one of the inventors of the instant application, Shuming Nie. Nie is also the declarant of the Rule 131 Declaration. Although Applicants' argument and the declaration assert that the claimed invention was conceived and reduced to practice prior to Lee, the article does not support this assertion. The article describes a CdSeTe semiconductor alloy formed into a nanocystal, but it does not describe or suggest two concentration gradients in opposite directions within the nanocrystal. Indeed, the article merely refers to nanocrystals with different ratios of selenium to telenium. *See* first page, left column, second paragraph; and Figure 1 and caption. Moreover, the declaration, although referring to various portions of the article, does not specifically mention the two concentration gradients. Accordingly, while the article may support a declaration and argument that a CdSeTe semiconductor alloy was conceived and reduced to practice prior to the Lee reference, it

does not do the same for a nanocrystal with two different concentration gradients as claimed.

Applicants' argument traversing the prior art rejection of record is therefore not convincing. Consequently, the rejection is maintained.

Conclusion

No claim is allowed.

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Leon Y. Lum whose telephone number is (571) 272-

2872. The examiner can normally be reached on Monday to Friday (8:30 am to 5:00 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark L. Shibuya can be reached on (571) 272-0806. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Leon Y. Lum/
Examiner, Art Unit 1641

/Nelson Yang/
Primary Examiner, Art Unit 1641